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App. No. 10/621,981  
Reply to final Office Action of May 26, 2006

**REMARKS/ARGUMENTS**

Reexamination and reconsideration are courteously requested. Claims 1 to 12, 14, and 17 to 31 are pending for the Examiner's consideration, with claims 1, 17, 22, 23, and 29 being independent claims.

**A. Rejections Under 35 U.S.C. § 103(a)**

Claims 1 to 9, 11 to 15, 17 to 21, 23 to 25, and 28 to 31 are rejected as being unpatentable over:

- a) U.S. Patent No. 6,924,040 (Maloney) in view of either:
- b) U.S. Patent No. 6,733,908 (Lee) or U.S. Patent No. 6,106,959 (Vance), when each is considered further in view of either:
- c) U.S. Patent No. 6,103,386 (Raybould) or U.S. Patent No. 6,395,343 (Strangman) or US 2005/0064213 (Subramanian).

Further, claims 10, 16, 22, 26, and 27 are rejected as being unpatentable over the same combination of references, and further in view of U.S. Patent No. 4,916,022 (Solfest). All of the above rejections are respectfully traversed.

Independent claims 1, 17, and 29 recite a transition region, between two segmented columnar ceramic layers, in which stabilized zirconia concentration decreases and a stabilized hafnia concentration increases along a transition gradient. This feature is neither taught nor suggested by any of the cited prior art, alone or in combination.

Maloney is the only cited prior art reference that discloses an embodiment in which hafnia is layered over zirconia, but the layers are not separated by a transition region in which the zirconia concentration decreases and the hafnia concentration increases. This deficiency is conceded in the office action. However, the Examiner relies upon either Lee or Vance for at

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least suggesting this feature. For this reason, each of Lee and Vance will be discussed individually.

Lee fails to teach or suggest a transition region, between two segmented columnar ceramic layers, in which stabilized zirconia concentration decreases and a stabilized hafnia concentration increases along a transition gradient, as set forth in the present claims. Lee discloses a layered structure that includes an outer stabilized zirconia (YSZ) layer 14. Immediately below the stabilized zirconia layer 14 is a barrier layer 22 that may include hafnia. In the passage spanning col. 7, line 37 to col. 8, line 7, Lee discloses that the barrier layer 22 may have a gradient construction in which the innermost region is largely hafnia, and the outermost region is largely the stabilized zirconia that ultimately forms the outer layer 14. While it is appreciated that Lee discloses a gradient from hafnia to YSZ, there is no teaching or suggestion in Lee to replace hafnia with a stabilized hafnia material. Only from reading the present specification would a person find motivation to make such a replacement. Returning briefly to the teachings of Maloney, a person of ordinary skill in the art would understand from Maloney that no such gradient is necessary between stabilized zirconia and stabilized hafnia layers. In fact, since the similarly stabilized oxide materials in Maloney have discrete boundaries, a person of ordinary skill in the art would determine that no gradient between the materials is necessary. Upon reviewing Lee, such a person would determine that when hafnia is not stabilized, a gradient is only necessary for proper bonding between the unstabilized hafnia and the YSZ layer. Since in the segmented columnar layers of the present invention include only stabilized zirconia and hafnia, a person would likely opt to follow the teachings of Maloney and forego a gradient between the two materials.

Vance also fails to teach or suggest a transition region, between two segmented columnar ceramic layers, in which stabilized zirconia concentration decreases and a stabilized hafnia concentration increases along a transition gradient, as set forth in the present claims. Vance is directed to the advantages provided by multilayered thermal barrier coating materials such as certain multilayered ceramics that can be used in place of a single layer of YSZ (col. 2, lines 55 to 67). A layered structure is depicted in FIG. 1, in which a middle layer 3 (and also the overlying thermal drop layer 2) may include YSZ (col. 3, lines 39 to 56). An upper layer 1

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disposed on either layer 2 or 3 may include hafnia (col. 3, line 18). A gradient may be used to transition between the layers (col. 4, lines 6 to 15). Thus, Vance is similar to Lee by merely disclosing a gradient from hafnia to YSZ. Still, there is no teaching or suggestion in Vance to replace hafnia with a stabilized hafnia material, and only from reading the present specification would a person find motivation to make such a replacement. Since in the segmented columnar layers of the present invention include only stabilized zirconia and hafnia, a person would not be motivated from reviewing Maloney together with Vance to provide a gradient between the adjacent stabilized zirconia and hafnia materials. For at least this reason, the rejections of the claims should be withdrawn since all of the pending claims include this feature.

In addition, all of the independent claims (1, 17, 22, 23, and 29) recite that columns are formed in a segmented yttria stabilized hafnia layer disposed on top of a first segmented columnar ceramic layer that also has columns formed therein, and that a structure-stabilizing material is interposed between columns of the segmented yttria stabilized hafnia layer. To emphasize the novelty of this feature, claim 23 recites the stabilizing material in the top layer in Jeppson type format. The uniqueness of this feature is evident by the fact that none of the prior art references teaches or suggests any type of segmented columnar ceramic layer that has a structure-stabilizing material interposed between columns, and is formed on top of another columnar ceramic layer. The Examiner's position appears to be that since Subramanian discloses a sintering or bond material (yttrium aluminum oxide) in a lower columnar ceramic layer, it would be obvious to interpose the same material in both the upper and lower columnar ceramic layers disclosed by Maloney. However, there is no motivation set forth in the prior art to do so. Simply because it is known to modify a lower columnar layer does not suggest that it is desirable to so modify an upper columnar layer as well. The several prior art references that disclose the use of a structure-stabilizing material do not suggest the need for another layer with such material formed therein. Maloney, the only reference that discloses the use of stacked columnar ceramic layers, does not disclose the need for any structure-stabilizing material whatsoever. Thus, a person of ordinary skill would not divine the top columnar ceramic layer, including a structure-stabilizing material, from the cited prior art. For at least this additional reason, the rejections of all of the independent (and dependent) claims should be withdrawn.

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Finally, claims 22 and 23 recite that the upper columnar ceramic layer is thinner than the lower columnar ceramic layer. In contrast, Maloney, the only reference that discloses the use of stacked columnar ceramic layers, suggests that the upper layer is thicker than the lower layer by contrasting the two layers using the description "thin" when mentioning a lower YSZ layer (col. 6, line 45). The Examiner comments that thickness adjustments merely amount to discovering an optimum value of a result effective variable that involves only routine skill in the art. However, the feature in claims 22 and 23 is not simply determining an optimal thickness, but a relationship between two layers. These claims do not recite an optimum value at all, but establish another inventive feature in which the upper columnar layer is thicker than the lower columnar layer. This is in stark contrast to *In re Boesch*, which the Examiner cites, in which a discrete value without supporting reasons behind the discrete value was rejected as an obvious modification. Since the prior art fails to teach or suggest the relationship recited in claims 22 and 23, the rejections of these claims and claims depending therefrom should be withdrawn.

#### E. Conclusion

In view of Applicant's amendments and remarks, it is respectfully submitted that Examiner's objections and rejections have been overcome. Accordingly, Applicants respectfully submit that the application is now in condition for allowance, and such allowance is therefore earnestly requested. Should the Examiner have any questions or wish to further discuss this application, Applicants request that the Examiner contact the Applicants attorneys at the below-listed telephone number.

If for some reason Applicants have not requested a sufficient extension and/or have not paid a sufficient fee for this response and/or for the extension necessary to prevent abandonment on this application, please consider this as a request for an extension for the required time period and/or authorization to charge Deposit Account No. 50-2091 for any fee which may be due.


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Respectfully submitted,

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